ALMA BOARD

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ALMA Science Advisory Committee (ASAC)
Report to the ALMA Board - Fall 2024

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*Viviana Guzmán, former Chilean ASAC Member, resigned the ASAC before the October 2024 meetings.

General Considerations:

- ASAC requests that all reports are made publicly available within a reasonable amount of time after Board Meetings.
  - [The ALMA Board meetings summaries | ALMA](#)
- As WSU proceeds from *planning phase* through *final design reviews* through *build and implementation*, it may not be necessary for ASAC to endorse subsystem components <u>unless</u> there is a direct science tradeoff or impact (e.g., receiver band upgrades). In general, ASAC is strongly supportive of the WSU upgrade and full implementation.
- We request the Board consider if the ASAC charges should be updated to reflect priorities during WSU implementation.

Permanent charges
1. Assessment of the performance of ALMA scientific capabilities: The ASAC shall indicate what information is required from the Joint ALMA Observatory (JAO) to perform this assessment.

Recommendations/issues:

Software, general operations and comment on progress/success of overall observatory

- The ASAC celebrates that new technical capabilities have been offered in cycles 10 and 11 despite a busy schedule of WSU preparations.

- The ASAC congratulates ALMA for the good progress in the planning of the WSU and is appreciative of the detailed updates and schedules provided.

- ASAC appreciates seeing the plans for the transition from legacy to WSU and understands that these plans are very much preliminary. ASAC stresses the importance of communicating the schedule and implications of parallel

deployment, which brings up a lot of interesting points on how to optimize science observations parallel with commissioning. The ASAC agrees with the gradual implementation of the WSU and the proposed requirements for the first WSU call for proposals. It also stresses its support for completion of the full WSU and requests the Board to keep this full implementation as the true goal of the project.

- The ASAC discussed the possibility of community projects during the transition to the WSU and noted the need for a clearer definition. Pros and Cons are noted and there was not a consensus on moving forward. ASAC was highly receptive to community projects for the new WSU system and happy to move forward on those discussions.
  - The transition period will likely be highly uncertain in terms of available time, array configuration, and technical capabilities:
    - Pros: having ALMA-managed projects with built in flexibility may maximize the science return during this period.
    - Pros: Could mitigate the challenge of addressing all possibilities in the call for proposals.
    - Pros: Community Projects will ensure a diverse science portfolio and legacy-like science for multiple users.
    - Pros: Community Projects at this stage could provide lessons learned on how to approach other similar initatives with the new WSU!
    - Cons: Community projects will consume available time for regular proposals in a period when time will already be greatly reduced - increasing proposal pressure and oversubscription to challenging and off-putting ways for the community.
    - Cons: Designing and implementing programs with enough flexibility will be extremely challenging and will likely need a lot of oversight and internal commitments from ALMA to ensure a good product. Additionally, staff will likely be overcommitted with other priorities to complete WSU, and may not have the time to work on details for such projects.
    - Cons: Representation for all community science would need to be ensured - niche communities, while smaller, still need the opportunity to have new science in this period.
    - Cons: WSU commissioning may have more flexibility with a large pool of B/C-rank science programs for non-engineering time (and/or pre-announced relaxation of QA2 pass criteria) than with community projects.

New Cycle 10 and 11 technical capabilities. While work on the WSU is now the focus of all technical developments, ALMA has continued to offer new technical capabilities during each cycle. In cycle 10, ALMA offered for the first time observations in Band 1 (I Stokes only) and the new Total Power GPU Spectrometer. During the Cycle 11 now starting, ALMA will offer full polarization in Band 1 on the 12m array, high frequency observations in long baselines, and 4x4 spectral mode on the 7m array. The ASAC congratulates ALMA for these achievements at a busy time with the WSU planning.

WSU project planning. The ASAC celebrates the successful passing of important milestones toward the WSU in the last few months. A major milestone was the Delta System Requirements Review / Initial Program Plan Review in July, which led to several detailed recommendations by the panel that are now under study for implementation. Additional milestones include the successful Preliminary Design Reviews (PDRs) of the Advanced Technology ALMA Correlator (ATAC), OSF Correlator Room (OCRO), both in June, and the Data Transmission System in October. Future PDRs will be carried out for the Wideband IF Processor in November, and for the new Band 6 and 8 receivers in 2025. In addition, phase 2 of the OCRO project has been submitted for approval by the Board, for which the ASAC notes its support. The ASAC congratulates ALMA for successfully passing all these milestones, which indicate good progress in the planning for the WSU.

WSU implementation. In preparation for the gradual implementation of the WSU, the ALMA Management Team has defined four different stages of the WSU system: initial, minimum, goal, and full. The initial WSU system will be the target of the assembly, integration, verification, and commissioning efforts, and will be offered to the community in the first WSU call for proposals (tentatively in 2029 as part of cycle 16). The Integrated Science Team has defined the technical capabilities of this Initial WSU, which include the same point source sensitivity as the current array and an order of magnitude increase in the spectral grasp at high spectral resolution. The ASAC agrees that these requirements are reasonable and sufficient for the first WSU call for proposals. Future capabilities will be deployed in the following cycles, as more antennas are upgraded and the new Band 6 and 8 receivers are installed, approaching ALMA to the Minimum WSU stage. The ASAC notes that the WSU Cost Book preparation only covers up to the Minimum WSU System. While this is reasonable given the uncertainty in the cost of the following WSU stages, the ASAC reiterates its support to the full implementation of the WSU, and requests that the Board maintains the full WSU as the final goal of this critical upgrade for the future of ALMA.

Community projects, The ASAC was asked for an opinion on the possibility of carrying out community projects during the transitional phase to the WSU. The concept of community projects is not well defined, and it was not clear whether they would be run in parallel to regular programs or instead of them. As a result, the ASAC cannot offer a definitive opinion at this moment, although a number of considerations resulted from the ensuing discussion. One consideration is that the transition period will likely be highly uncertain in terms of available time, array configuration, and technical capabilities, so any community project will need to be extremely tolerant to multiple last-minute changes (e.g., configuration, sensitivity, etc.). This may make both the call for proposals and the design

of such projects very challenging, and it may be more convenient to ask for observations as "shared-risk" with flexibility included in these programs. Another consideration is that community projects may benefit some communities but increase the time pressure for minority fields. Any attempt to implement these projects will therefore require strong support from a wide user community. Finally, since ALMA post WSU will be much more capable than the legacy system, it may make more sense to carry out any community projects after the WSU has been implemented. The ASAC will be glad to explore these and other issues in more depth once the limitations during the WSU and the concept of community projects have become clearer.

2. Assessment of the technical aspects of the ALMA system performance: The ASAC shall indicate what information is required from the JAO to perform this assessment.

Recommendations/issues:

- We applaud the entire ALMA staff for achieving the highest-ever number of science operating hours in Cycle 10 with each of the 12-m Array, 7-m Array, and TP telescopes.

- It is gratifying to see that the large majority of Cycle 10 data (MOUS) were delivered to PIs within a month of the full observations, thanks in part to the start of automated data delivery in December 2023. The presence of a small number of observations that took months to deliver, mostly due to the need for manual QA, is an area for future improvement.

- The tracking of operational KPIs/metrics seems to be working well to further improve ALMA operations. We encourage this to continue.

- ASAC is interested in updates on the ongoing cyber-attacks and implementation for firewalls/prevention. Following the major attack that shut down operations (autumn 2022), there was an assumed priority to upgrade systems and firewalls. Details on how ALMA is maintaining and monitoring the infrastructure to avoid future major events would be appreciated.

Record high observing hours! There was a record high number of observing hours in Cycle 10 in all three arrays thanks to good weather, good coordination between science and engineering/maintenance time, and careful monitoring of the various reasons for scheduling downtime. SB completion percentages are good; in particular, the completion percentages for B and C graded projects increased compared to the last cycle. The completion rate for B9 and B10 projects has also increased thanks to more high-frequency observing hours than ever before (possibility of daytime observations), but this also shows that upgrading high-frequency projects from C to B grade was a good strategy.

3. Assessment of the science outcomes from ALMA: Statistics on publications, citations, press releases, web sites, etc. collected by the Executives shall be collated by the JAO, and analyzed by the ASAC.

Recommendations/issues:

- We are pleased to see that the community is making excellent use of ALMA, consistently publishing a high number of papers, and performing at a top level. Comparisons with other international, state-of-the-art facilities with comparable demand, including JWST (now that is going on three years of science operations), in future reports will provide useful details for assessing impact across the field.

- We are pleased to see the information on WSU on the ALMA observatory website. To further disseminate the information on the WSU, it may be of interest to link WSU information to the ALMA science portal.

- ASAC requests that in addition to the other publication statistics, DDT metrics are also provided.

- ASAC requests to be informed on the outcome of the study of publications, currently underway at ESO, once completed. Comprehensive reviews of publications and impact across all programs (small, medium, large, legacy, archival, TOO and DDT) on a 3–5-year cadence should be conducted to assess the return on investment/time for ALMA on various scales and effort levels.

Publication Studies: This request is to implement a metric to assess *how the science is done and progressing*. Understanding trends of impact as a function of observing hour, and how this varies, would provide significant details on program allocation in small vs large programs to help advance subfield science.

4. Recommendation of ways to maximize ALMA's scientific impact: This includes review of the scientific effectiveness of the Proposal Review Process after each Proposal cycle.

Recommendations/issues:
- ASAC was in a majority agreement for removing proprietary time on DDT proposals as recommended by ALMA, with fair and equal opportunities to appeal for proprietary time waivers.
  - Access to raw data for DDT proposals was also discussed and ASAC agreed that there should be no exception provided to the PI and all data releases should be available to all users simultaneously. DDT should get QA2 data release regardless of whether raw data is released.

- ASAC agreed that an AI policy for proposals and reviews needs to be established for future cycles. JAO should consult AI policies of other observatories and academic institutions. It should be made clear on why there is a policy, which is to: (1) avoid plagiarism (e.g., AI uses knowledge it learned from somewhere, and may not be properly credited.); (2) maintain confidentiality. (e.g., The proposals you evaluate, your review comments, and your rankings, are confidential. They should not be fed into software that learns from, shares, or stores the input.); and (3) observance of the review assignment (e.g., The onus of the review process is on the Reviewer, and obligations to fulfill this in a comprehensive manner deemed appropriate by peers is critical.).
    - ASAC recognizes that AI could be used beneficially without violating the three principles above. For example, it can be used to improve the English language and level the playing field for the widest range of ALMA proposers. Such use could be allowed but would be hard to monitor/regulate.
    - ASAC discussed that using AI to write proposals should be permitted and recommends that proposers claim and disclose how AI was used to the JAO (not for reviewers to see or evaluate). This information could be helpful when refining future policies if needed.
    - Reviewers should be discouraged from generating content for their assessments. ASAC had detailed discussions on implications for usage and challenges with maintaining proposal content confidentiality.

- ASAC had a majority consensus to retain the ranks from individual reviewers in the review reports. (This "rank" is the one among the ten proposals that each reviewer compared.) ASAC also recommends that the review reports better communicate the position of each proposal among all ALMA proposals by using deciles (rather than quartiles), as this will provide a more detailed perspective for evaluating the success of the proposal.

- ASAC is pleased to learn that there has been a steady influx of new users to ALMA, with 18% of the PIs being the first-time PIs in Cycle 11, compared to 19% in Cycle 10. Metrics on new users, both proposing and awarded time, should be maintained to understand the success of dual-anonymous and success for next generation astronomers.

- ASAC is pleased that JAO responded to the "comments to JAO" by e.g. contacting the corresponding reviewers during Stage 2. The ASAC recommends that JAO continues to support this opportunity and to continue to inform reviewers of the significance for Stage 2 reviews. Adding a reviewer survey to Stage 2 is worth a trial in the next cycle and follow-up with continued discussion of its success. Consideration to make Stage 2 a mandatory part of the review process should be made.

Maintaining Ranks in Reviews: ASAC discussed the pros and cons of communicating the individual ranks to the PI and the general consensus was for keeping the ranks. If the Observatory changes anything, it should be adding more information rather than omitting it, to help the proposers evaluate the success of their proposal and put it into context. Ideas include using deciles instead of quartiles and publishing the distribution of ranks for proposals that got grade A, grade B, or grade C. The ASAC would appreciate to see these distributions for Cycle 10-11 proposals at the next ASAC meeting and then for future cycles as well.

AI Policy: The ASAC agrees that ALMA needs to have a policy about the usage of AI both for proposal writing and the review process, keeping in mind that it will be a challenge to enforce such policies. ASAC discussed what aspects of AI may be acceptable (e.g., spell-check, grammar-check, translation, consulting for information) and what is to be avoided (e.g., plagiarism, breach/infringe confidentiality, content generation); disclosing the use of AI should be encouraged, the Observatory then could start collecting statistics on the use of AI this way, though people may have concerns about how this information is used; it would be good to spelling out why the policy exists! The policy may be different for proposal writing and review writing.

Proprietary Time for DDT proposals: ASAC discussed JAO's proposal to reduce the default proprietary period for DDT programs from six months to zero, with the possibility of requesting non-zero proprietary periods in exceptional cases. Our general consensus was in favor of the proposal, given its merits (e.g., better use of ALMA data from highly topical targets; benefit to the community by motivating or optimizing proposals for the next cycle; better balance with the overtaking of peer-reviewed regular programs). Our support comes with the understanding that JAO is not considering changing the proprietary period for regular programs. If there is a request for raw data from a DDT project, then the raw data should also be made open access. We note that there may be cases where exceptions are desirable (see comments from EASAC in Charge #5), and expect that the decision will be made in a fair and judicious manner. We emphasize the importance of explaining the change in detail to the community, so that the community knows exactly what to expect and feels treated fairly under clear rules. We add a suggestion that the statistics for DDT proposals be disclosed at the level of regular proposals, so that the community can better appreciate the opportunity.

Filling undersubscribed LST ranges: Continuing to emphasize low-subscription and the corresponding configurations of LST ranges in the proposal guide in each cycle should be done and additional guidance to find these details (especially for non-experts) may be helpful. More technical maintenance could also be prioritized during such periods, if possible.

5. Reporting on operational or scientific issues raised by the wider community as communicated by the three regional Science Advisory Committees (ANASAC, ESAC and EASAC).

Recommendations/issues:

ESAC:
- ESAC received user feedback on two non-standard observing projects that indicate lack of adequate communication between JAO, the ARC Nodes, and users. We encourage more transparent and timely communication on challenging technical issues to the PI.
- ESAC is also happy to see that JAO is developing a python script to help PIs to check the scheduling feasibility of their projects during proposal preparation. ESAC also recommends that the execution probability of projects is communicated to PIs to help them identify technically challenging observations and help improve their proposals in the future.
- As noted during the SRR, and further discussed, the increased data rate even at the initial WSU stage, is too high for the current data processing system. While a new data processing system (RADPS) is planned, it will not be ready for Cycle 16 when the first WSU scientific observations are planned. ESAC is very concerned by the lack of a plan for a data processing system able to cope with the WSU highest data rate tail when they will be first available.

EASAC:
- Some comments were raised that were not necessarily in full support of waiving the proprietary period of DDT programs. Although the point that the removal of proprietary periods would benefit other research teams is well understood, the removal would not be appropriate for, for example, observation targets that are known only by certain research groups. Appropriate application of the guidelines for making exceptions is expected.
- It is also noted that the number of submitted and accepted DDT proposals from EA PIs is relatively low. EASAC will continue to discuss how the DDT framework can be better for the EA community.
- EASAC is concerned that the number of submitted and accepted LP proposals by EA PIs remains relatively low as before. As a statistic that means the same thing, the distribution of requested observation times for Grade A+B proposals in the 12 m array seems to indicate that EA PIs tend to prefer shorter observation times.
- In the Cycle-11 proposal review, the rank distribution of proposals from EA PIs has improved to the same level as that of the EU PIs, which EASAC recognizes as a very pleasing result. It would be worthwhile to investigate what factors might be responsible for this improvement.

ANASAC:

- Some proposers are not satisfied with the proposal "ranks" method and would prefer to see more granular evaluations such as points or scores.
- Discussions on ways to improve the review process were made and consideration for multiple categories to fill out may be more useful than just a "free-form" strengths/weakness field as well as having guidance on a rubric to use.
- ANASAC discussed if DPR was effectively removing more "risky" projects from occurring. Perhaps DDT is the option for that, but it is not clear if that is the best path for potentially ground-breaking discoveries.
- Discussions of "last cycle opportunities before WSU" were made. Community projects were one option, but consideration for possibly moving all uncompleted projects to be the priority that final legacy cycle would ensure completion and a consistent dataset for those projects.

6. Assessment of the scientific impacts of the ALMA Development Program, and particularly of new projects that are proposed.

Recommendations/issues:

- ASAC is impressed with the ongoing development of the WSU receivers for Band 2, Band 6v2, and Band 8v2. We are excited that Band 2 may become available for PI science as early as Cycle 13.

- There are limited "ongoing" development programs due to focus and funding priorities falling to WSU planning, design, and implementation. There are some regional/community projects underway that are discussed in the regional SACs. ASAC would appreciate clarification on the intent of this charge and requests more details on what the Board is seeking during WSU implementation.

- ASAC understands that ngOT will not be ready for full deployment by Cycle 12 and agrees with ESO's plan of a beta release with limited capabilities to ALMA and ARC-node staff to ensure full functionality before switching over.

- ASAC encourages ALMA to build on the success of recently completed development studies and work toward implementing the result, when possible, for instance improving the atmospheric model beyond 300 GHz, changing the interpolation algorithm.